UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

HONEYWELL INTERNATIONAL INC., and HONEYWELL INTELLECTUAL PROPERTY, INC.,

Plaintiffs,

vs. No. 99-309 (GMS)

HAMILTON SUNDSTRAND CORPORATION,

Defendant.

DEPOSITION OF PETER J. SUTTIE
San Diego, California
Thursday, June 29, 2000
Volume 2

Reported by:
RENEE KELCH
CSR No. 5063
Job No. 14814

APPEARANCES:

For Plaintiffs:
KIRKLAND & ELLIS
BY: JONATHAN F. PUTNAM
BY: VICKIE REZNIK
Attorneys at Law
153 East 53rd Street
New York, New York 10022-4675
(212) 446-4695

For Defendant:
MARSHALL, O'TOOLE, GERSTEIN, MURRAY & BORUN
BY: WILLIAM E. McCRACKEN
BY: THOMAS A. MILLER
Attorneys at Law
233 South Wacker Drive
6300 Sears Tower
Chicago, Illinois 60606-6402
(312) 474-6300

Also Present:

BEN SMALL, Hamilton Sundstrand Corporation

UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

HONEYWELL INTERNATIONAL INC., and HONEYWELL INTELLECTUAL PROPERTY, INC.,

Plaintiffs,

vs. No. 99-309 (GMS)

HAMILTON SUNDSTRAND CORPORATION,

Defendant.

Deposition of PETER J. SUTTIE, Volume 2, taken on behalf of Plaintiffs, at 600 West Broadway, Suite 1100, San Diego, California, beginning at 9:18 a.m. and ending at 3:39 p.m. on Thursday, June 29, 2000, before RENEE KELCH, Certified Shorthand Reporter No. 5063.

INDEX

San Diego, California, Thursday, June 29, 2000
9:18 a.m. - 3:39 p.m.

PETER J. SUTTIE,
having been first duly sworn, was examined and testified as follows:

MR. McCRACKEN: I just want to acknowledge we received your 30(b)6 notices for next week. Because Mr. Suttie's available today, we would like to point out that as we consider responding to the 30(b)6 notices, which we haven't yet finished our investigation who are most appropriate to answer that, you may wish to bring up those issues with Mr. Suttie today, so that you can have your questions answered in the event that he becomes -- is, in fact, determined to be the person most knowledgeable about one or more of those requests. We simply offer that because of the short period of time remaining in discovery. We just want to point that out.

MR. PUTNAM: I would like to state for the record that, first of all, I will, obviously, inquire of Mr. Suttie whatever topics I think he may have knowledge of. But that doesn't, in my view, relieve Hamilton Sundstrand of the obligation to give us a witness for each of the topics that we notice who is speaking on

behalf of the company. And I think it clearly would not be sufficient to after the fact, in other words after I finish Mr. Suttie's deposition today, to tell me that he was, in fact, your witness for one or more of the topics. I think I'm entitled to know that while I'm deposing him.

I have the notice here, if you want to take a minute and confer and tell me if, in fact, you are going to designate Mr. Suttie for one or more of these topics at the outset of the deposition. That would certainly be appropriate. Obviously it wouldn't be much notice to me, but I know we're all working on a fairly tight schedule here. But I don't think it's proper or sufficient for you to give after-the-fact notice or designation of someone as a 30(b)6 witness.

MR. McCRACKEN: We're unprepared to make the designation. We understand your position. We don't necessarily agree with it, but it's been made of record.

MR. PUTNAM: Okay. Well, I'm going to continue with Mr. Suttie. And just so the record is clear, as of right now Mr. Suttie is not a 30(b)6 witness for any topic; is that correct?

MR. McCRACKEN: I don't have an answer for you on that because our investigation isn't complete. It is entirely possible that Mr. Suttie, in fact, is the

person most knowledgeable about one or more of the issues. And what we will attempt to do is give you a better answer as soon as possible. That's the most I can commit to at this point.

MR. PUTNAM: Okay. And I think it makes sense for me to continue with the personal deposition of Mr. Suttie. I don't necessarily agree with the procedure you're planning to follow. But rather than spend more record time, I think it makes sense to proceed with Mr. Suttie's deposition today.

(Witness sworn in.)

EXAMINATION

BY MR. PUTNAM:

Q Good morning again, Mr. Suttie.

A Good morning.

Q Have you had a chance to review your deposition transcript from your previous deposition session?

A Yes.

Q And were there any areas of that transcript that you found incorrect or incomplete?

A I was asked to review it for content, not for specific -- there were a few typographical errors, I thought. I didn't see anything which I thought was incorrect. But I would like to -- I did not review it with that as my intent.

Q Okay. When you say that you didn't find anything that was incorrect but you find some typographical errors, I guess I'm not sure what you mean.

A There were some words that I thought were misspelled. But I scanned it very quickly. I was not reviewing it with the intent of signing the document at that time.

Q I take it, given your review of the transcript, as you sit here this morning, there's nothing in that earlier transcript that you viewed as incorrect or inaccurate; is that correct?

A There was nothing I found in my quick review, correct.

Q Have you had any discussions with anyone who you understand to be working as an expert witness for Hamilton Sundstrand in this litigation?

A Discussions with regard to what?

Q The case in any way.

A No details.

Q Have you had any discussions with anyone who you understand to be actually or prospectively an expert witness for Sundstrand in this litigation?

A Yes.

Q Who is that?

A Alan Greubel.
Q Anyone else?
A No.
Q And you understand that Mr. Greubel may be an expert witness in this matter; is that right?
A No. I understand that he would be having a discussion with you.
Q And in what context did you speak to Mr. Greubel?
A Solely that, that he was going to be talking to you. We did not discuss at all the contents of my testimony or the technical issues which you are inquiring about.
Q And because of the way you answered my first question, I'm still a little puzzled. Is it your understanding that Mr. Greubel is going to be an expert witness in this proceeding?
A I do not know.
Q Has anyone told you that he might be an expert witness in this proceeding?
A No.
Q Is Mr. Greubel a current employee of Sundstrand?
A Yes.
MR. PUTNAM: Off the record.

(Discussion off the record.)
MR. PUTNAM: Back on the record.
Q Mr. Suttie, have you been involved in any testing of an APS 3200 in any way connected with this litigation?
A No.
Q To your knowledge, has anyone at Sundstrand conducted testing on the APS 3200 in connection with this litigation?
A Yes.
Q What testing are you aware of?
A I was aware that John Szillat ran some tests. But I do not know the specific details.
Q Do you know what aspects of the APU he was testing?
A No.
Q Do you know what his conclusions or findings from any testing was?
A No.
Q Do you know if anyone other than Mr. Szillat was involved in those tests?
A Yes.
Q Who else was involved in those tests?
A The test engineer.
Q Who was that?

A I don't know. If I can explain.
Q Sure.
A We always have a test engineer. It would normally be one person. I don't know for sure if it was that person in this case.
Q And who would the normal person be?
A Barbara Jones.
Q And her position is test engineer?
A Test engineer. She runs the engine for that.
Q Other than Mr. Szillat and the test engineer, was anyone else involved in those tests?
A The test mechanic.
Q And do you know who that individual would be?
A No, I don't.
Q Would there be an individual who typically would serve that function during a test?
A Yes.
Q And who is that?
A Lynn Shorb.
Q Is that a man or a woman?
A That's a man.
Q Anyone else involved in that test?
A No.
(Discussion off the record.)
(Deposition Exhibit 42 marked.)

MR. PUTNAM: Back on the record.
Q Mr. Suttie, let me hand you what the court reporter has marked as Suttie Deposition Exhibit Number 42, which is a multi-page document.
MR. McCRACKEN: Could we go off the record for a moment?
(Discussion off the record.)
MR. PUTNAM: Back on the record.
Q Actually, Mr. Suttie, before we get to Exhibit 42, let me put in front of you what was previously marked at the earlier session of your deposition as Suttie Deposition Exhibit Number 9, which is Revision N of the APS 3200 electronic control box requirements specifications.
Do you have that document in front of you?
A I have a document which appears to be that from the cover page.
Q Can you please turn to page 161 of the exhibit? Can you tell me what the graphs on this page depict, please?
A They depict the sequencing logic of the bleed control valve and the IG -- the guide vane actuator on logic.
Q When you say the sequencing logic of those two things on logic, I guess I don't understand the answer.

A I gave a long answer. They portray the sequencing of the BCV and the IGV when the bleed is commanded on.
Q And what is the sequencing relationship between those two items in the 3200?
A The bleed control valve must open first, because we found that high pneumatic flow through the load compressor puts additional mechanical load on the bleed control valve, and as such, there was insufficient actuator force to open the valve. So we sequenced the on components, which have to move in such a way that the BCV is already open by the time the high pneumatic -- the high mechanical forces apply.
Q Now, is this talking primarily about when the 3200 is first turned on; is that right?
A No.
Q What situations of operation of the 3200 do these graphs come into play, then?
A When the bleed is commanded on. The APU may already be running.
Q Okay. And you're saying that the bleed must be commanded on before the IGVs are open?
A No.
Q Okay. Then what are you saying?
A The bleed control valve must be commanded open

before the IGV is commanded to open.
Q Before the IGVs are commanded open, is any air coming in through the compressor -- into the compressor?
A Yes.
Q So when the inlet guide vanes are closed, that does not fully close off the opening to the compressor; is that right?
A Correct.
Q As compared to the full amount of air that is able to come in when the inlet guide vanes are fully open, approximately what percentage or amount of air comes in when the inlet guide vanes are fully closed?
MR. MCCRACKEN: Objection; ambiguous.
THE WITNESS: I don't know.
BY MR. PUTNAM:
Q Is it under 25 percent?
A Yes.
Q Am I right that the APS 3200 has a sensor that senses the position of the inlet guide vanes?
A Yes.
Q And is that sensor in the APS 3200 located between or in sequence between the inlet guide vanes and the electronic control box?
A Yes.
Q And what does the sensor for the inlet guide

vanes on the 3200 sense?
A Position.
Q Of the inlet guide vanes?
A No.
Q Okay. What does it sense, then?
A Linear position of the inlet guide vane actuator.
Q And is the inlet guide vane actuator the mechanical device that actually opens and shuts the inlet guide vanes?
A Yes.
Q Does it do anything else?
A No.
Q And I take it from sensing the linear position of the inlet guide vane actuator that the electronic control box can figure out where the inlet guide vanes themselves are located at any given time; is that right?
A In most cases.
Q What would be the cases in which that's not correct?
A There's a pin which connects the IGV actuator to the IGV. If that pin fails, there's no relationship between IGV actuator and IGV angle.
Q I take it the failure of that pin would not be part of normal operation; correct?

A Correct.
Q I should have asked you before, other than your own deposition transcript, have you read any part of the transcript of any of the other depositions that have been taken in this case?
A No.
Q Have you heard of something in your work as an engineer called a function generator?
A Yes.
Q Give me what you understand by the term "function generator."
A Usually a piece of lab equipment which generates periodic functions, such as sine waves or square waves or triangular waves. Usually a fairly large piece of lab equipment on a bench.
Q Have you ever heard of the phrase "function generator" being applied to a component or aspect of an APU?
A No.
Q Turning again to the charts on page 161 of Suttie Deposition Exhibit Number 9, there appear to be separate lines on each chart for BCV command and BCV, and then, in turn, IGV command and IGV. Do you see that?
A Yes.

Q Why are those separately denominated in these graphs?
A Because the command signal is a digital number in the electronic control box. And that can move very quickly. Effectively instantaneously. However, the bleed control valve being a piece of mechanical equipment, cannot move so fast. So there are periods where the commanded position moves quickly and it takes some time for the mechanical BCV to follow the command.
Q Is it fair to say in the APS 3200 the operation of the bleed control valve and the operation of the inlet guide vanes is synchronized with each other?
A No.
Q Is it fair to say in the APS 3200 that the operation of the bleed control valve and the operation of the inlet guide vanes is sequenced so that those two aspects of the APU work together effectively?
A No.
Q Isn't that what this chart shows?
A You say "is it fair to say." For the -- this is four seconds of operation, which could be a tiny fraction of the operation of the APS 3200. So I would not say it was fair to say they were sequenced together.
Q What's the difference between the two graphs that appear on page 161 of Suttie Exhibit 9?

A On the top figure, you will notice the first action of the BCV is to go to the full open position. It goes there for a very short period, at which point we measure where the full open position is. This is a calibration of the travel, of the full range travel of the bleed control valve. Then you see the bleed control valve coming back to a mid position.
Once the ECB has powered up and done that compensation, there is no need to do it again. The compensation remains in memory. So the top figure is the first time bleed is commanded on. Should bleed be commanded off and then back on again, the lower of the two pictures would pertain, because there is no need to repeat the compensation.
Q When you say the first time bleed is commanded on, do you mean the first time in the life history of an APU? Or the first time in any given period of operation of an APU?
A The first time bleed is commanded on following the APU start.
Q And as I understand your testimony, each successive time that that particular APU is turned on the BCV and IGV will first follow the top chart, and then if bleed is turned off and then on again, for such subsequent occasions follow the lower, the bottom chart

on page 161; correct?
A Correct.
Q Am I correct that these charts show that at least for the period immediately after bleed is commanded on, the position of the bleed control valve determines, in part, the operation of the inlet guide vanes?
MR. McCRACKEN: Objection; ambiguous.
THE WITNESS: What do you mean by "in part"?
MR. PUTNAM: Let me restate the question.
Q Am I correct that these charts show that at least for the period immediately after bleed is commanded on, the position of the bleed control valve determines the operation of the inlet guide vanes?
MR. McCRACKEN: Objection; ambiguous.
THE WITNESS: What do you mean by determines the operation of the IGVs?
BY MR. PUTNAM:
Q Tells the IGVs how to operate.
A The BCV does not tell the IGV how to operate.
Q Directly impacts the operation of the IGVs?
MR. McCRACKEN: Objection; not a question.
THE WITNESS: Can you restate the question, please?
BY MR. PUTNAM:

Q Am I right that these charts show that the position of the bleed control valve directly impacts the operation of the inlet guide vanes?
MR. McCRACKEN: Objection; vague.
THE WITNESS: I'm struggling. What do you mean by "directly impacts"?
BY MR. PUTNAM:
Q Well, maybe I misunderstood your testimony earlier. I thought your testimony earlier was that these charts showed how the bleed control valve and inlet guide vanes are sequenced to work together at the start of bleed sequence. Is that not correct?
A Correct.
Q All right. Let me ask the question this way, then: Is it correct that in the APS 3200 the bleed control valve and the inlet guide vanes are sequenced to work together at the start of bleed operation?
A Correct.
Q Can you turn, please, to page 63 of this document?
Do you have page 63 of Suttie Exhibit 9 in front of you, sir?
A I do.
Q Can you read to yourself the four paragraphs at the top of the page and then look up when you have?

You see this is the section labeled 3.3.4.5.2?
A I hadn't finished reading the four paragraphs you requested.
Q I apologize. Go ahead and finish that, please. Are you ready, sir?
A Yes.
Q My first question is, do you see that this section is labeled in the document 3.3.4.5.2?
A Yes.
Q And is this section talking about the same aspect of the 3200 operation that we were just looking at in those two graphs?
A Yes.
Q Do you see that the fourth sentence of the first paragraph of the section I've just directed you to says, "When the compensated IGV position is within 0.5 capital V of the IGV demanded position, the BCV --" off the record.
(Discussion off the record.)
MR. PUTNAM: Back on the record.
Q In the sentence that I read part of into the record before I sneezed, the capital V stands for volts; is that right?
A Correct.
Q Do you see that the fourth sentence of the

first paragraph on page 63 of Suttie Exhibit 9 reads, quote, "When the compensated IGV position is within 0.5 volts of the IGV demanded position, the BCV shall initiate closed loop control," period, end quote? Do you see that sentence, sir?
A Yes.
Q What does that mean?
A It means when the IGVs are close to their demanded position, the bleed control valve closed loop control, which we discussed previously, will start.
Q And without repeating all the testimony from the last session, am I right that the BCV closed loop control is the delta P over P and proportional and integral control that we discussed last time?
MR. MCCRACKEN: Objection; vague.
THE WITNESS: Can you be more specific?
BY MR. PUTNAM:
Q Let me just ask you the open-ended question. What is the closed loop control of the bleed control valve that's referred to in that sentence?
A The control system governing the bleed control valve as defined in the various figures and paragraphs of this document.
Q Well, but the control base on the inlet guide vanes is also part of that system; right?

A No.
Q If you turn to page 128 of the exhibit, that has Figure 12A, which is one of the figures that we were looking at before? Can you confirm that, please? Do you have Figure 12A in front of you, sir?
A Yes.
Q And do you see that this figure is labeled, "Closed loop PI surge control"?
A Yes.
Q And the PI stands for proportional and integral; correct?
A Correct.
Q Does Figure 12A show the closed loop bleed control valve control that is referred to on the -- or in the fourth sentence of the first paragraph on page 63 of this document?
A Yes.
Q Now, during this initial start-up period, am I right that the delta P over P sensors are operating?
MR. MCCRACKEN: Could you read back the question when the commotion has died down?
MR. PUTNAM: Off the record. No, let's keep going.
(Discussion off the record.)
MR. PUTNAM: Back on the record.

Q Am I correct that the delta P over P sensors are operating in the sense that they are measuring pressure the whole time when the APS 3200 is operating?
A Correct.
Q And what we saw in those earlier graphs was that sometimes the surge mechanisms will be turned off, correct, the surge control mechanism?
A What do you mean by surge control mechanism?
Q Explain to me what again -- because I see you have the two graphs in front of you still -- what it is that triggers the operation of the sequence shown in those graphs.
A Figure 12A?
Q I'm sorry, the two graphs that are on page 161. Then we'll come back to Figure 12A.
A Both of these figures are triggered by a bleed on command.
Q And is the opposite of a bleed on command a bleed off command?
A Yes.
Q And immediately before the bleed on command is triggered, in your words, what's happening? The bleed valve is fully open?
A No.
Q It's fully closed?

A Yes.
Q And am I correct that in the operation of the APS 3200, when the bleed valve goes from fully open to some other state when a bleed on command is issued, that's when the start-up routine depicted on page 161 kicks in; correct?
MR. McCRACKEN: Objection; vague.
THE WITNESS: Can you repeat the question, please?
MR. PUTNAM: We'll have the court reporter read it back.
(Record read.)
THE WITNESS: No.
BY MR. PUTNAM:
Q When does that routine kick in?
A When the bleed is commanded on.
Q If you turn for a minute to Figure 12C in Suttie Exhibit 9. Do you have that in front of you?
A Should I close up all the other figures?
Q I don't want to make life too complicated. We may refer back to them. But for the time being I want to focus on Figure 12C, which is on page 130. Do you have that in front of you?
A Yes.
Q Am I correct that the upper left-hand box on

the logic in the upper left-hand box of Figure 12C that controls operation of the bleed control valve?
MR. McCRACKEN: Objection; ambiguous.
THE WITNESS: No, you're not correct.
BY MR. PUTNAM:
Q What's incorrect about that statement?
A The block you're referring to does not generate a bleed control valve command.
Q What does it do?
A It sets up criteria necessary for -- which need to be satisfied before the bleed control valve can be moved to its commanded position.
Q All right. Let me try it this way, Mr. Suttie. Let me ask you, because I know you've been flipping back and forth a little, to get the following pages from Suttie Exhibit 9 in front of you: Page 63, which has the text we looked at earlier; Figure 12C on page 130; and page 161, which was the sequencing graphs that we looked at earlier.
MR. McCRACKEN: Mr. Suttie is looking at a stapled document as well. Is this part of the exhibit?
MR. PUTNAM: He's looking at the copy of Exhibit 9 that you gave him. I think part of it was stapled together and part of it was not.
MR. McCRACKEN: Which you provided to us.

this figure depicts in a graphic form the bleed on routine that we've just been talking about and that's referred to on page 63 of the exhibit?
A Yes.
Q And am I correct that for the first period of time once a bleed on command is given during operation of the APS 3200, it is this logic in the upper left box of Figure 12C that controls operation of the bleed control valve?
MR. McCRACKEN: Objection; ambiguous.
THE WITNESS: Can you repeat the question, please?
(Record read.)
THE WITNESS: Can you define what you mean by "period of time"?
BY MR. PUTNAM:
Q I think we saw that the first five seconds or something after the bleed valve was commanded on; correct? That's the bleed on command was given; correct?
A That's the period where the sequence in logic is applicable, yes.
Q Let me ask the question again, then. Am I correct that for the first five seconds after a bleed on command is given during operation of the APS 3200 it is

Okay.
THE WITNESS: I'm sorry, can you repeat the pages you wish me to look at?
BY MR. PUTNAM:
Q 63, Figure 12C on page 130, and it's actually Figure 28A on page 161. Okay. Do you have those in front of you?
A Yes.
Q Am I correct that in the operation of the APS 3200, when a bleed on command is given, the APU follows the bleed control valve and inlet guide vane sequencing shown in Figure 28A to ensure proper operation of the bleed control valve?
A Yes.
Q And looking at the fourth sentence on page 63 that we looked at before, am I correct that that sequencing is followed until a certain inlet guide vane position is measured by the APS 3200; correct?
A No.
Q What's not correct about that statement?
A When the criteria in the fourth sentence of that first paragraph is met, the BCV is rate limited to the position that it is commanded to go to. So it is not -- it is still not on a closed loop control. It is being scheduled by a rate number.

Q Then what does the sentence mean when it says, "when the compensated inlet guide vane position is within half of a volt of the demanded position, the bleed control valve shall initiate closed loop control?
A That statement is in contradiction with the figure.
Q Which correctly describes the operation of the APS 3200?
A I don't know for sure.
Q Who would know that?
A A software engineer.
Q All right. Focusing on the text on page 63 for a minute. Am I correct what that is saying is that when the APS 3200 measures the inlet guide vanes in a certain position, it then kicks into the closed loop control for the bleed control valve?
A Correct.
Q And that closed loop control is the control based on the measurement of, and the proportional and integral control of delta P over P; correct?
MR. MCCRACKEN: Objection; ambiguous.
THE WITNESS: Can you restate the question?
(Record read.)
THE WITNESS: By delta P on P, do you mean what we discussed previously as defining delta P on P?

BY MR. PUTNAM:
Q Yes.
A Delta P static over P static?
Q Correct.
A Then the answer is, there are -- yes.
Q Let me see if I can get a clean answer. The closed loop control is the control based on the measurement of and the proportional and integral control of the delta P over P variable used by the 3200; correct?
MR. MCCRACKEN: Objection; asked and answered.
THE WITNESS: Can you repeat the question?
(Record read.)
THE WITNESS: As shown on Figure 12A, correct.
BY MR. PUTNAM:
Q Okay. Mr. Suttie, you can put that exhibit away for a minute. And I want to show you what was marked in the deposition of Mr. Szillat as Exhibit 30.
Mr. McCracken, do you have an extra copy to show the witness?
MR. MCCRACKEN: I don't know if I have an extra copy.
MR. PUTNAM: Do you have a copy to show the witness? I have a copy myself.
THE WITNESS: Do I need to reassemble this

document in a way that's retrievable later?
MR. PUTNAM: Why don't you just put it to the side. I'll take care of that at the next break.
I'm sorry, I'm going to show him Exhibit 24, not Exhibit 30.
MR. MCCRACKEN: Do you have an extra copy you can provide the witness?
MR. PUTNAM: Yes. And as soon as I get it clipped, I'm going to do that.
MR. MCCRACKEN: Okay.
BY MR. PUTNAM:
Q Mr. Suttie, let me show what you what was marked as Exhibit 24 during the deposition of your colleague, Mr. Szillat.
Do you have that document in front of you?
A I have a document that says "Exhibit 24," yes.
Q And do you see that your name is listed on the front page as one of the approval signatures for this document?
A Yes.
Q Can you tell me what this document is, please?
A It's a systems requirements specification for the APS 3200.
Q AND what's the purpose at Sundstrand for creating a systems requirements specification?

A To specify the requirements for various components in the control system.
Q Is this document one that is given to customers who purchase or who are considering purchasing the APS 3200?
A No.
MR. PUTNAM: Let's take a short break now.
MR. MCCRACKEN: Sure.
(Recess.)
MR. PUTNAM: Back on the record.
Q Mr. Suttie, let me hand you what the court reporter has marked as Exhibit 42, which is a multi-page document labeled, "Troubleshooting guide," with production numbers HSA 240000 through 240147. Do you have that document in front of you?
A I have the document that has the front and back pages that you mentioned, yes.
Q And approximately 145 pages in between?
A Approximately.
Q Can you tell me if you recognize this document, sir?
A Yes, I do.
Q What is it?
A It's a troubleshooting guide.
Q And is this for the APS 3200?

A Yes.
Q And can you tell me the purpose of Sundstrand creating this troubleshooting guide?
A It's a presentation that was made to airline line mechanics.
Q What's an airline line mechanic?
A A mechanic who works for an airline and his function is line maintenance.
Q What do you mean by line maintenance?
A Maintenance at the airline's airports, where airlines serve and have a maintenance function.
Q Is it fair to say that Suttie Exhibit 42 is a document created by Sundstrand to give customers of the APS 3200 an explanation of the operation of that APU?
A No.
Q What's not accurate about that description?
A This document does not define the operation of the APU.
Q Is it fair to say that Suttie Exhibit 42 is a document created by Sundstrand to give to customers of the APS 3200 to describe the operation and troubleshooting for that APU?
A No.
Q What's the purpose of Sundstrand giving this document to its 3200 customers?

A To explain how to troubleshoot if problems or failures occur on the APU. It does not define the operation of the APU.
Q Is it fair to say that Suttie Exhibit 42 is a document created by Sundstrand to give to customers of the APS 3200 to explain how to troubleshoot any problems that arise in their operation of that APU?
A Can you repeat that, please?
(Record read.)
THE WITNESS: To troubleshoot some problems.
BY MR. PUTNAM:
Q Okay. Subject to that modification, do you agree with my description of the document?
A Yes.
Q Can you turn to the page that is labeled in the lower right-hand corner, page 5 of Suttie Exhibit 42? Do you have that page in front of you?
A Yes, I do.
Q You see that it has the statement, "APS 3200 system consists of three control loops"?
A Yes.
Q How is the phrase "control loops" being used here?
A Control system. A system whereby a parameter is measured, a parameter is acquired, and a -- in this

case digital system makes a computation and determines whether a desired position or function is being obtained.
Q Does this page list the three principal control systems that are featured in the APS 3200?
A Define what you mean by "principal control systems."
Q Let me ask it this way: Does this page list the three control systems that are featured in the APS 3200?
A Yes.
Q And is it fair to say that each of those three control systems is a necessary part of the operation of the APS 3200?
A Yes.
Q In other words, if you didn't have any of these three control systems, the APS 3200 would not function; correct?
MR. McCRACKEN: Objection; ambiguous.
THE WITNESS: What do you mean by "function"?
BY MR. PUTNAM:
Q Would not operate as it is supposed to operate.
A True.
Q And the three control systems listed on page 5 of Suttie Exhibit 42 are the fuel control system, the

bleed control valve system, and the inlet guide vane control system; correct?
A Correct.
Q Now, under fuel control on this page, I see two separate bullets. One that says, "start acceleration," and one that says "steady state." Do you see that?
A Yes.
Q What is the meaning of those separate subpoints under fuel control system?
A Sub bullet 1, "start acceleration," defines the control system, which controls fuel. And it does it in a way so as to accelerate the APU from zero percent speed to 100 percent speed.
The "steady state" bullet defines the control of the fuel flow to maintain 100 percent speed.
Q Is one of those two types of fuel control more important than the other?
A No.
Q Does the APS 3200 use a different fuel control logic during the start acceleration period than it does during the steady state period?
A What do you mean by "fuel control logic"?
Q Well, are there differences in the parameters that are measured or in the commands that are given between the start acceleration period and the steady

state period?
A What do you mean by commands that are given?
Q Why are they listed separately on this page, sir?
A Because they occur at different times of APU operation.
Q Why is it important that the APS 3200 have a start acceleration fuel control system?
A Because it is necessary to put the correct amount of fuel into the APU during start. And that amount of fuel is not a fixed value.
Q Why is it necessary to put a correct amount of fuel in during start?
A Because if you don't, it won't start.
Q Is there also an element of efficiency at work, in the sense that some start acceleration fuel control systems might be more efficient than other such systems?
A Define "efficient."
Q What do you understand by efficient?
A I understand efficient to be a measure of energy consumed versus energy utilized for useful purpose.
Q Is the start acceleration fuel control logic for the APS 3200 designed to maximize the energy efficiency of that operation as you just defined the

term?
A No.
Q What is it designed to maximize?
A Start reliability.
Q And why is that important?
A Because when the customer asks for the APU to start, the APU should start.
Q And what would happen if the APS 3200 did not have a start acceleration fuel control system that was reliable?
A The APU may not start when required.
Q Would you agree with me that that would be a disadvantage from a customer's perspective?
A Yes.
Q Can you turn to page -- strike that.
Would you agree with me that customers would be unlikely to purchase an APU that did not start reliably?
MR. MCCRACKEN: Objection; speculative.
THE WITNESS: I don't know.
BY MR. PUTNAM:
Q In designing the 3200, sir, wouldn't you agree with me that you attempted to design an APU that started reliably?
A Yes.
Q And wouldn't you agree with me that at least

one reason you did that was the commonsense notion that customers are less likely to purchase an APU that did not start reliably?
A With that commonsense notion, yes.
Q Would you turn to page 19 of Suttie Exhibit 42, please? Do you have that page in front of you?
A Yes, I do.
Q Do you see the first sub bullet on the page refers to bleed flow transducer, and then capital P24?
A I do.
Q Does the P24 constitute a reference to something else in this document?
A No.
Q What does P24 signify there?
A A bleed flow transducer. The delta P on P sensor we have called it previously.
Q What is the designation "P24" referring to?
A All connectors on the harness, the APU harness have a P number. It assists line maintenance in finding a particular sensor they're trying to find.
Q And is there a key somewhere in this document or a picture in this document that would show the various P numbers on the system?
A I can't -- I don't recall.
Q Can you take a minute to look through and see

if you find anything like that?
A While it is not intended to be a reference, pages marked 240111 do list the names of the LRUs and their associated P number if they have one.
Q And LRU stands for line replaceable unit; correct?
A Correct.
Q And that would be a physical wire line that runs for some part of the APU; correct?
A No.
Q Define line replaceable unit as it's used there, then.
A A component which can be removed and replaced by line maintenance mechanics.
Q Do you see P24 listed anywhere in the table starting on 2401111?
A Yes.
Q Where is that?
A Page marked 240114.
Q Where on that page?
A One, two, three, four major rows from the top, second column.
Q In the left-hand column of that row, it says "reverse flow"; do you see that?
A Yes.

Q Is that being used synonymously with surge here?
A No.
Q What does reverse flow there refer to?
A A condition where air can be backfed from the main engines of the airplane into the APU.
Q And is that the same thing as surge?
A Yes.
Q Turning back to page 19, sir, am I right that this page lists four sources of data that the bleed control valve relies upon for its operation of the APS 3200?
MR. MCCRACKEN: Objection; ambiguous.
THE WITNESS: Can you repeat the question, please?
(Record read.)
MR. MCCRACKEN: Objection; vague.
THE WITNESS: Can you repeat that one more time?
(Record read.)
THE WITNESS: I don't recall. I need to look back to the details on the BCV specification.
BY MR. PUTNAM:
Q Well, what do you understand the heading "Receives data from" at the top of this page to mean?

that inlet temperature and inlet pressure is used to determine a control setpoint?
A Yes, I do.
Q What do you understand by the term "control setpoint" as it's used in that bullet?
A To be the required position for the bleed control valve.
Q Okay. What do you understand the difference between to be -- strike that.
What you do you understand to be the difference between control setpoint as it's used on the second bullet in this page and software setpoint as it's used in the third bullet on this page?
A I don't know. Software setpoint is a very vague term.
Q In what sense does the bleed control valve in the APS 3200 use the inlet guide vane position to determine a software setpoint?
MR. MCCRACKEN: Objection; vague.
THE WITNESS: In my understanding of software setpoint the IGV position does not determine a setpoint.
BY MR. PUTNAM:
Q Well, in what sense does it determine a setpoint for the bleed control valve in the APS 3200?
A It doesn't.

A It was intended to indicate the sensors which provide data to the bleed control valve control.
Q Do you see the third bullet down under the heading "Receives data from" is "inlet guide vane position"?
A I do.
Q And do you see that page 19 of Suttie Exhibit 42 here says, "Inlet guide vane position P21, used only to determine a software setpoint"?
A I do.
Q What is meant there by a software setpoint?
A It's an erroneous statement.
Q What do you mean by that?
A It's wrong.
Q Well, let's take in pieces, what do you understand in general by the term "software setpoint"?
A A demanded -- a requirement which is coded into software.
Q And what would you understand the difference to be between a control setpoint and a software setpoint?
MR. MCCRACKEN: Objection; vague.
THE WITNESS: What do you mean by "control setpoint"?
BY MR. PUTNAM:
Q Do you see the second bullet on page 19 says

Q Why does it say in this troubleshooting manual that Sundstrand gives to its customers that inlet guide vane position does determine a setpoint for the bleed control valve for the APS 3200?
A The statement is erroneous.
Q Have you ever noticed this supposedly erroneous statement before I showed you the document today?
A Yes, I have.
Q When did you notice that?
A Tuesday of this week.
Q And is this a document, Suttie Exhibit 42, that you reviewed in connection with your deposition session today?
A No.
Q So is it your testimony that you totally unrelated to the fact that you were being deposed today happened to be reviewing the document we've marked as Suttie Exhibit 42 this past Tuesday?
A Yes.
Q What was the context or reason for your reviewing this document?
A I do a training class in-house for the Hamilton Sundstrand learning program on APS 3200 design. And this sheet was -- is a part of that training class material. So in the context of doing the training on

Tuesday, I noticed this statement.
Q And what, if any, actions have you taken to have this supposedly erroneous statement corrected?
A None.
Q Have you, or to your knowledge anyone at Sundstrand, contacted any customers who've been given this troubleshooting guide to tell them that there's an erroneous statement about inlet guide vane position and setpoint contained in the guide you've given them?
A No.
Q If you look at page HSA 240113, sir. At the bottom of that page, or near the bottom of that page --
A 240143?
Q 113. Do you see in the middle column near the bottom of the page it says IGVACTR, and then P21?
A I see it -- which particular? Yes.
Q Actually, those two abbreviations followed by P21 occurs a couple different places on this page; correct?
A Yes.
Q First of all, IGVACTR, is that an abbreviation or shorthand for inlet guide vane actuator?
A Yes.
Q And is that a line replaceable unit in the APS 3200 as you defined the term a couple minutes ago?

A Yes.
Q And am I correct that this document, Suttie Exhibit 42, is using the designation P21 to refer to the inlet guide vane actuator?
A Yes.
Q And am I right that the inlet guide vane actuator is the piece of hardware that physically opens or closes the inlet guide vanes?
A Yes.
Q And that's the piece of hardware whose position is measured by the electronic control box in the APS 3200; correct?
A Can you repeat that for me, please?
(Record read.)
THE WITNESS: Yes.
BY MR. PUTNAM:
Q Let me get another document for you.
Mr. Suttie, during the development of the APS 3200 was there a term or a variable that was referred to as the B, B as in boy, factor?
A Yes.
Q What was the B factor?
A It was an equation, an algorithm to define a parameter.
Q And what parameter was the B factor used to

define?
A Well, B factor itself was the parameter.
Q And how was the B factor used? Or how was it contemplated that the B factor would be used in the APS 3200?
A It was used to determine which side of curve, known as the delta P on P curve, the load compressor was running on.
Q Which you say "which side of the curve," what do you mean?
A As I mentioned in the previous deposition, there is a relationship between delta P on P and flow, air compressor flow. There is not a unique solution one needs to know which -- the curve has an apex for accurate control. The ECB needs to know which side of that curve the load compressor is functioning.
Q Is the B factor something that's used in the current APS 3200 today?
A No.
Q Why not?
A It was -- it did not adequately accomplish the function.
Q What function?
A To determine which side of the curve the load compressor was functioning on.

Q What's used in the APS 3200 currently in operation today instead of the B factor?
A A pressure ratio measurement.
Q Is that delta P over P?
A No.
Q What is that pressure ratio measurement?
A It's P -- the load compressor outlet pressure ratio to the load compressor inlet pressure.
Q Isn't that -- haven't you just defined delta P over P?
A No.
Q What's the difference between what you just defined and delta P over P?
A Inlet air goes into the load compressor, ambient air is taken into the load compressor, and that is discharged over the load compressor at a high pressure. That is the pressure ratio across the machine. Delta P is as we have described it.
Now, you could say that the pressure ratio I've just discussed is a delta, yes, I agree. But the delta, as we have discussed it, is a delta between pressure in the diffuser and the pressure in the load compressor outlet duct. So it is -- and the P of the delta P on P as we described it, all static pressures, is the duct pressure.

Q The pressure ratio in the APS 3200 that is used instead of the B factor, am I right that those are measurements of total pressure rather than static pressure?
A No.
Q Are they measurements of static pressure?
A Yes.
Q So for the pressure ratio, you're comparing the static pressure at the inlet to the load compressor to the static pressure at the outlet from the load compressor; is that right?
A Yes.
Q And for the delta P over P that we spent more time during your deposition discussing, it's the static pressure in the diffuser compared to the static pressure at the outlet of the load compressor; correct?
A Yes.
Q So does the pressure ratio measurement use the same pressure taps as the delta P over P measure, or do they use discrete pressure taps?
A Could you repeat that?
(Record read.)
MR. MCCRACKEN: Objection; vague.
THE WITNESS: I don't understand the question.
BY MR. PUTNAM:

Q Am I right that for the delta P over P measurement, there are two discrete places where pressure is measured in the APS 3200?
A Yes.
Q And would you refer to the thing that does the measuring at those places as a pressure tap?
A Yes.
Q Does the pressure ratio measurement that you said replaced the B factor, does that use those same pressure taps as the delta P over P? Or does it use separate pressure taps?
A It's neither of those two.
Q What is it, then?
A Intake pressure is measured by an intake pressure sensor. One sensor, one tap. The diffuser has a tap which goes to a sensor. The duct has a tap which goes to a sensor. That second sensor I described does two functions. It measures the duct pressure and it measures the differential, what we've called delta P. So in total there are three sensing elements.
Q As I understand your testimony, one of those three plays a role in both the pressure ratio measurement and the delta P over P measurement; correct?
A Correct.
Q And what's the location of that pressure sensor

that plays both roles?
A It's on -- mounted on the plenum, the APU plenum.
Q Am I right, as air is drawn in through the compressor and sent into the system, that's the middle of the two measurement points that air would pass?
A No.
Q Is it the final -- I'm sorry, the middle of the three measurement points that the air would pass?
A No.
Q Is it the final one that the air would pass?
A Yes.
Q So it's the one closest to, for instance, the bleed control valve?
MR. MCCRACKEN: Objection; ambiguous.
THE WITNESS: Can you define it -- no.
BY MR. PUTNAM:
Q Why not?
A It's on the BCV.
Q I used the phrase before, "total pressure." What do you understand by the term "total pressure"?
A An equivalent pressure which is measured in airflow which is moving. You obtain the pressure as a result of the -- the base static pressure and you also get an impulse effect due to the flow of the air.

Q Is it fair to say that total pressure is static pressure plus an impulse effect?
A Yes.
Q And the impulse effect is based on the velocity of airflow?
A Yes.
Q Am I right that total pressure is a flow-related parameter in an APU?
MR. MCCRACKEN: Objection; vague.
THE WITNESS: What do you mean by flow-related?
BY MR. PUTNAM:
Q Related to the airflow.
A Can you repeat that, please?
Q Let me state the question with my elaboration. Am I right that total pressure is a flow-related parameter; that is, it is related to the airflow in an APU?
A What do you mean by airflow in an APU?
Q You don't understand that term?
A There are so many places where you could measure airflow.
Q And, sir, my question has nothing to do with where you measure it. My question is, in an APU, am I right that total pressure is a flow-related parameter in the sense that it is related to the airflow?

MR. MCCRACKEN: Objection; vague.
THE WITNESS: Yes.
MR. PUTNAM: Please mark this as Exhibit 43.
(Deposition Exhibit 43 marked.)
BY MR. PUTNAM:
Q Mr. Suttie, I've handed you what's been marked as Suttie Exhibit Number 43, which is a document which has production numbers HSA 152238 through 152244.
Do you have that document in front of you, sir?
A I have those sheets of paper, yes.
Q Can you turn to the second of the pages that make up Exhibit 43, which is a coordination memo? Do you see that?
A Yes.
Q Is any of the handwriting on this page yours?
A Yes.
Q What handwriting on this page is yours?
A Top of the page is written, "They are always a day ahead." I wrote that. I wrote the line on the left-hand side of the page predominantly outside of the vertical line.
Q And that's -- the latter is where there are, I guess, five names listed and then the phrase, "Please review and comment, then incorporate, thanks, Pete"; is that right?

A Correct.
Q Is this document one that you received from Turbomeca during the development of the APS 3200 and then passed on to other members of your development team?
A Yes.
Q And do you see the chart with two rows that is in the middle of the page there?
A Yes.
Q Am I right that that was a chart created not by you but by someone at Turbomeca?
A Correct.
Q Can you tell me what this chart is depicting?
A The top line is alpha, in degrees. Alpha is intended to be IGV angle. And the lower row is B critical.
Q Okay. And is this chart showing a relationship between inlet guide vane position and what you call here B critical?
A Yes.
Q And is B critical the same as the B factor you were talking about earlier? Or is it something different?
A It's different.
Q What is B critical?

A A particular value of B.
Q What particular value of B?
A The critical value intended to indicate which side of the delta P on P curve we were on, as I mentioned earlier.
Q How are you using the term "critical value" here?
A It's a threshold.
Q Is B critical a subset of some sort of B?
A No.
Q Then I don't understand what it is.
A B is a computed parameter. It varies. B critical is a fixed number, as depicted on this table you reference.
Q Am I right that the B factor that Sundstrand contemplated using for the APS 3200 was a direct function of inlet guide vane position?
MR. MCCRACKEN: Objection; vague.
THE WITNESS: No.
BY MR. PUTNAM:
Q What's incorrect about that statement?
A The B factor is not a function of inlet guide vane position.
Q Was the B factor that Sundstrand contemplated using for the APS 3200 related to the inlet guide vane

position?
A No.
Q Is it your testimony it was totally independent of the inlet guide vane position?
A As I recall. I would need to go back to look at the B factor equation to be absolutely sure of that. But as I recall, B factor is not a function of IGV angle.
Q Then why in this chart that we're looking at does it display B factor and inlet guide vane angle in tandem with each other?
A It doesn't.
Q I thought that's what you did say?
A It says B critical. It's a fixed number. Not the B factor.
Q How was B critical used in the APS 3200?
A It was compared with B, with the computed parameter.
Q So was B critical a setpoint of some sort for B?
A No.
Q Is B critical used in the APS 3200 that's in actual operation today?
A No.
Q Was B critical ever used in an APS 3200 in

operation?
A Yes.
Q When was it used?
A In the software versions prior to 3.0.
Q And what time frame is that?
A From entry into service, January, '94, so it's sometime in '95. I don't know exactly.
Q How was B critical used during that period of time?
A It was compared with the computed B factor to determine which side of the delta B on B curve we're operating on.
Q And what did the system do once it was determined which side of the delta P over P curve you were operating on? What did it do with that information?
A It used that determination to cause the bleed valve, control valve commanded position to be effective, or to be ignored.
Q And when you say the bleed control valve commanded position, do you mean the position generated by the delta P over P measurement?
A I mean the control logic, which we have discussed earlier, related to P on P, which produced a signal called BCVCTL, I believe.

Q As I understand it, all APS 3200s that went into service between January, 1994 and sometime in 1995, used the B factor compared to B critical, as you've just described it; is that right?
A Yes.
Q Do APUs that went into service during that period still operate that way, or was their software changed?
A Software was changed.
Q So am I right that APUs that went into service after this period in 1995 -- first of all, that APUs that went into service after the period of 1995 never used the B factor compared to B critical in actual operation?
A Correct.
Q And APUs that had gone into service during that first year and a half or so used the B factor compared to B critical during their initial in-service operation, but then had their software reprogrammed to no longer use those factors?
A Correct.
Q And that reprogramming took place sometime in 1995; is that your testimony?
A Sometime in '95. Or early '96.
Q And if we found out when software version 3.0

for the APS 3200 was installed in the field, would that be the time that the change-over was made?
A Yes. With the caveat that 3.2, as it finally ended up being, was recalled for a period, for another reason; previous version of software was used again for a while until version 4.1 entered service.
Q And when did that recall and relapse to the earlier version take place?
A '95, '96.
Q And what's the relationship between 3.0 and 3.2?
A I don't recall.
Q Okay. Just so we have the testimony sequenced correct. Is it your testimony that until version 3.0 of the software was released, the APU used the B factor to B critical comparison, that there was then a period when APUs did not do that, a period again where APUs did do that while a software bug was being fixed, and then when version 4.1 entered service APUs never -- APUs thereafter did not operate using the B factor and B critical?
A Correct.
Q So if we find out when version 4.1 entered service, after that date and after that software was installed on every given APU in service, there was no

use of the B factor and B critical; correct?
A Correct.
Q Now, during the time the B factor and B critical was in actual use for the APS 3200, am I right that as shown on this chart here on Exhibit Suttie 43, B critical was a function of inlet guide vane position?
A Can you define again what you mean by is a function of?
Q Well, let me ask you an open-ended question. What was the relationship between B critical and inlet guide vane position when B critical was in use for the APS 3200?
A The relationship was as defined in this table.
Q So when B critical was in use for the APS 3200, a given inlet guide vane position produced a given B critical value; is that right?
A Correct.
Q And that B critical value was then compared to the measured B factor; correct?
A Yes.
Q And was proportional and integral control applied to the difference between the B critical factor and the measured B factor?
A No.
Q Was any type of control compared -- applied to

the difference between those two values?
A No.
Q Was there some sort of table that determined based on that value whether the -- what we've been calling closed loop surge control logic would control the bleed control valve or not?
A Can you repeat the question, please?
Q Let me restate it slightly. During the period of time when the APS 3200 used B and B critical, how did the comparison, or how was the comparison between B and B critical used to affect operation of the surge control valve?
A It wasn't.
Q What was it used for?
A To determine which side of the delta P on P curve the APU was operating on.
Q And what did the APS 3200 do with that information?
A It used that information to allow the BCVCTL control signal to pass through to the BCV or to be ignored.
Q Was the B critical factor ever compared to the delta P over P measurement?
A No.
Q Suttie Exhibit 9 that we were looking at

operation of the bleed control valve for the APS 3200. How far back in history are they accurately -- an accurate depiction of the operation of that bleed control valve?
A When you say back in history, do you mean a time?
Q Yes.
A Approximately late '96.
Q Other than the use of B critical, and the B factor, whose history you've described, has there been any other change to the bleed control valve operation or logic for the APS 3200 from the time the APU was put into operation to the present day?
A Yes.
Q What other changes have there been?
A That I can recall right now, the BCV setpoint was originally a fixed value. It was made a function of inlet temperature. I'm sure there were other changes of less magnitude which I don't recall right now.
Q Am I right that if we trace through the various revisions of ESR 0677, which is the APS 3200 electronic control box requirements specifications, we should be able to pick up the various differences in bleed control valve logic during the history of the 3200?
A Yes. With the caveat that I mentioned last

earlier is Revision N of the APS 3200 requirement specifications; correct?
A Correct.
Q Would there be an earlier revision version of the APS 3200 requirement specification that contained a discussion of the operation of the B factor and B critical?
A Yes.
Q Do you know what version that might be?
A I don't recall exactly.
Q Can you give me an approximation, just so I know where to start looking for?
A I think it's J.
Q J as in John? I'm sorry, that was a yes?
A Yes.
Q Unfortunately, I don't have revision J or whatever specific revision -- version contained the B factor depiction in front of me. But am I correct that Figures 12A through D in that version or their equivalent, that is, the figures that show operation of the bleed control valve, would in that revision contain a depiction of the use of the B factor and B critical?
A I don't recall.
Q I think your testimony before was that Figures 12A to D in Suttie Exhibit 9 depict the current

time that this is a requirements document, and it's not always translated a hundred percent accurately into the operational codes.
Q The BCV setpoint, is it your testimony that when the APS 3200 originally went into operation, that setpoint was a fixed value?
A Yes.
Q And that's the setpoint to which the delta P over P measurement is compared; correct?
A Correct.
Q Over what period of time -- and I think you said this before. The date when the APS 3200 went into in-service operation, that was roughly January, 1994; is that right?
A Correct.
Q And as of January, 1994, I take it the BCV setpoint was a fixed value; correct?
A Correct.
Q When did that get changed?
A It was definitely changed in version 4.1. I don't recall specifically version 3.2. 3.0. I don't recall.
Q So no later than the implementation of version 4.1; correct?
A Correct.

Q And when was version 4.1 of the software implemented?
A Late '96, as I recall.
Q And the BCV setpoint changed from a fixed value to a function of inlet temperature. I take it that was made both with respect to new APS 3200s being delivered by Sundstrand and with respect to APS 3200s that had been previously delivered by Sundstrand and that were in operation in the field; correct?
A Correct. The APUs at that time were delivered by Turbomeca.
Q All the APU -- APS 3200s in the field as of whenever it was in 1996 that version 4.1 was released got the update of version 4.1; correct?
A Correct.
Q And that update, at least one effect of it was to make those APS 3200s operate using a BCV setpoint that was a function of inlet temperature; correct?
A Correct.
Q And that's how they operate today; correct?
A Correct.
Q Why did Sundstrand go from a fixed value for the BCV setpoint to a BCV setpoint that was a function of some other parameter?
A What do you mean by some other parameter?

Q I thought you said now it's a function of inlet temperature?
A So you mean specifically inlet temperature?
Q Yes. Why did Sundstrand make the change?
A There was some conditions of surge operation at altitude, high altitude performance.
Q And how was that connected to the change?
A Those surges could be avoided by making the setpoint a function of inlet temperature.
Q How did that help avoid such surge?
A By providing more margin to the control system.
Q What do you mean by more margin?
A More -- a greater delta between the -- I used the delta word twice. A greater difference between the delta P on P and surge, of the delta P on P setpoint.
Q So am I right that by making the bleed control valve setpoint a function of inlet temperature, Sundstrand's purpose was to make the delta P over P setpoint further away from surge conditions?
A Yes.
Q And did Sundstrand consider any other options, anything else that it could -- that the setpoint could be a function of before deciding to use inlet temperature?
A I don't recall.

Q Who is the person at Sundstrand who would have been responsible for making the decision to use inlet temperature?
A The team made the decision.
Q And who was the head of the team in 1996?
A I was.
Q And can you think of who on your team would have had responsibility for that aspect, for that issue?
A Ed Edelman.
Q Why did Sundstrand decide to use or to make the BCV setpoint a function of inlet temperature as opposed to something else?
A Turbomeca suggested it.
Q Who at Turbomeca suggested it?
A I don't recall.
Q Did Sundstrand undertake any testing of the use of inlet temperature to set the setpoint as opposed to some other parameter?
A I don't recall.
Q Do you know if Turbomeca undertook any such testing?
A I don't recall.
Q Was the person at Turbomeca who suggested the use of inlet temperature someone named Gerard Hardy?
A I don't recall.

Q Am I right that when you made that change to the software, there was no corresponding change to the hardware for the APS 3200?
A Correct.
Q In other words, even before that software change was made, the system was measuring inlet temperature; correct?
A Correct.
Q It just wasn't using that to adjust the setpoint; correct?
A Correct.
Q Am I right that when you decided to make the change, there was a significant advantage to using a parameter that was already being measured as opposed to using some parameter that the current hardware did not measure?
MR. McCRACKEN: Objection; vague.
THE WITNESS: What do you mean by parameter that did not -- was not measured?
BY MR. PUTNAM:
Q A parameter that the hardware configuration for the 3200 didn't pick up.
A Yes.
Q Now, why did you decide it made sense to make the setpoint a function of inlet temperature?

A Turbomeca suggested it.
Q And did you blindly accept that, or did you think about whether that was a sensible way to control the 3200?
A We thought about it.
Q And did you conclude that was a sensible way to control the surge system for the 3200?
A Yes.
Q Why was it sensible?
A The flight test data that we obtained from Airbus indicated what the ambient temperature was when the surge condition occurred. Therefore, it was logical, sensible to assume that making the delta P on P setpoint a function of temperature would have avoided that condition.
Q In the APS 3200 that's in operation today, am I right that there is a fixed relationship between the inlet temperature and the BCV setpoint?
A Yes.
Q And that relationship is coded into the software that runs the 3200; correct?
A Correct.
Q So the actual delta P over P measurement is something that any given APU picks up at any given moment? The setpoint that it's compared to is something

that's coded into the software; right?
A As a function of inlet temperature, yes.
MR. PUTNAM: Off the record.
(Discussion off the record.)
(Lunch recess taken from 11:44 a.m. to 12:49 a.m.)
BY MR. PUTNAM:
Q When the APS 3200 is in operation, am I right that the air is continuously being brought in through the load compressor?
A Yes.
Q And is there -- is it that there's an impeller, the thing that actually draws the air in through the load compressor?
A Yes.
Q What would happen if the system or the impeller stopped turning and stopped bringing air in through the load compressor?
A I don't understand the question.
Q Let me ask it this way: The impeller that's drawing in the air in the APS 3200, is that always rotating at the same speed during operation of the 3200?
A Effectively the same speed.
Q Why do you say effectively the same speed?
A One of the control algorithms we talked about

earlier was steady state speed control. It is possible for transient loads to slightly deviate that speed for it not to be an absolute constant. But it is the aim of that control group to maintain a constant speed.
Q So am I right that variations in the amount of air being brought in at any one time is a function of the position of the inlet guide vanes in the 3200?
MR. MCCRACKEN: Objection; ambiguous.
THE WITNESS: Amount of air being brought into where?
BY MR. PUTNAM:
Q Into the load compressor.
A If I could answer it this way: The amount of air going through the load compressor changes as IGV angle changes.
Q And it does not change based on any other factor in the 3200; correct?
A Define what you mean by "amount of air."
Q The volume of the air being brought in.
A The volume of air? True. Volume of air. In answer to your question. Can you repeat your question?
Q Let me restate the question. Which I think you've just answered yes to. But let me restate the question.
Am I right that the volume of air going through

the load compressor in the APS 3200 changes as IGV angle changes but does not change based on any other factor?
A I believe that to be true, yes.
Q In the APS 3200, am I right that if the amount of air being brought in through the load compressor got too low, got to too low a level, that would create a risk of surge?
A No.
Q Would that -- is it your testimony that would not create a risk of surge?
A Not necessarily.
Q Would it increase the risk of surge if the volume of air came too low?
A Not necessarily.
Q In what circumstances would it?
A If the downstream ducting to the load compressor was constricted, there is no place for that, the air to go. A back pressure is built up. If there is no back pressure on the load compressor, even low flows will not cause surge.
Q In fact, as the 3200 is designed, is it designed so that there is a minimum level of flow always being brought in through the load compressor?
A No.
Q What's the lowest amount of flow being brought

in through the load compressor for the 3200?
A I don't recall the number.
Q Is there -- I know you don't know the number, but is there a minimum amount of flow that gets brought in through the 3200 load compressor?
A There is a small amount of leakage airflow when the IGVs are closed which acts to cool the load compressor.
Q And that small amount is always being brought in through the 3200; correct?
A When the IGVs are closed, yes.
Q And when the IGVs are open to whatever extent on the 3200, that small amount, plus additional air is coming in through the load compressor; correct?
A Correct.
Q But the amount of air coming in through the load compressor in the 3200 never falls below the small amount of air that comes in when the IGVs are closed; correct?
A Again with the assumption that there is a place for the air to go once it's got through the load compressor.
Q With that assumption, my statement is correct?
A Correct.
Q And if there was not a place for the air to go,

by Turbomeca was delta P divided by P. It was a function of airflow. Pressure alone is not a function of airflow. A single pressure measurement itself is not a function of airflow. You could have the same pressure at a static level as you do with flow.
BY MR. PUTNAM:
Q And as I understand it, in operation of the APS 3200, the parameter you're measuring needs to be a function of airflow in order for the system to work; is that right?
A Airflow through the load compressor.
Q Okay. So am I correct that in operation of the APS 3200, the parameter that you're measuring needs to be a function of airflow through the load compressor in order for the system to work?
A Yes.
Q Would measuring delta P, that is, the change in pressure from one point to another, be a function of airflow through the load compressor?
A Yes. But it's not a unique relationship. It doesn't give you all the information you need.
Q What information would just the delta P measurement not give you that you need?
A A reference to ambient conditions. If you were at -- on ground, your static pressures, the duct

which is the assumption that you articulated, that would create a risk of surge; right?
A Correct.
Q That amount of air that comes in when the inlet guide vanes are closed, that amount is a function of the opening that exists even when the inlet guide vanes are fully closed; correct?
A Correct.
Q So that amount is based on the geometry of the hardware for the 3200; correct?
A Yes.
Q And the geometry of the hardware for the 3200 is something that is fixed when any given APU is sent into operation; right?
MR. McCRACKEN: Objection; ambiguous.
THE WITNESS: Yes.
BY MR. PUTNAM:
Q The Sundstrand system measurement of delta P over P, what's the effect of dividing the delta P by P as opposed to just using a delta P measurement as part of the surge control system?
A Could you repeat the question? I didn't hear a word.
(Record read.)
THE WITNESS: The relationship supplied to us

pressure that we discussed, is a certain volume, which is different from what it happens to be at 20,000 feet.
Q So by dividing the delta P measurement by P, the APS 3200 takes into account ambient conditions; is that right?
A As I understand the system, yes. Ambient pressures.
Q So by dividing the delta P measurement by P, the APS 3200 takes into account ambient pressures; is that your testimony?
A Yes.
Q We talked earlier about the concept of total pressure. Is total pressure a measurement of ambient pressure?
A No.
Q What is it a measurement of?
A It's a static pressure in -- close to that sensor, plus an effect as a result of the flow.
Q Would total pressure vary as a function of ambient pressure?
MR. McCRACKEN: Objection; ambiguous.
THE WITNESS: All other things being equal, then yes. But it -- the geometry and everything else would have to be exactly the same.
BY MR. PUTNAM:

Q When you say the geometry and everything else, you mean the geometry of the physical environment in which total pressure is being measured?
A No. I mean everything about the engine. The IGV, the impeller, the diffuser.
Q If all those things are held constant, then total pressure would vary as a function of ambient pressure; correct?
A Yes.
Q Can you define for me the word "pneumatic"?
A High pressure air, would be how I would define that.
Q Is the airline -- let me ask it this way: The APS 3200, one of the things it does is supplies air to the airline; correct?
A To the airplane.
Q Sorry. One of the things the APS 3200 does is supply air to the airplane; correct?
A Correct.
Q And as I understand, one of the things specifically the 3200 does is supply high pressure air to the airplane; correct?
A If the definition that high pressure is 60 pounds per square inch, yes.
Q Meaning that it supplies air that is more

to pump air in a certain direction, would have air forced backwards through it by a higher pressure source.
Q When you were working on the design and development of the APS 3200, did you ever run any reverse pneumatic flow tests?
A Yes, we did.
Q And what was the purpose of running those tests?
A To ensure that the APU protection mechanisms functioned adequately to isolate the APU from that external source.
Q And what is or what are the APU protection mechanisms employed by the APS 3200?
A Closing the bleed control valve.
Q From what source would the main engine air get into the APU?
A Through a duct.
Q Is there a particular duct where that -- which is at risk of passing the air in the wrong direction?
A There is a particular duct, yes, which connects the APU to the aircraft.
Q And the concern with reverse pneumatic flow is that air comes back up that duct towards the compressor; right? The APU compressor?
A The concern is the check valve in that duct,

pressurized than atmospheric pressure; correct?
A Correct.
Q And the airplane or the components of the airplane to which the APS 3200 supply air are pneumatically powered; correct?
A Yes.
Q Have you ever heard of anything called a reverse pneumatic flow test?
A In what context?
Q In the context of an APU.
A Yes.
Q What is a reverse pneumatic flow test in the context of an APU?
A When it is possible for main engine high pressure air to backflow into the APU.
Q So this is high pressure air generated not by the APU but by the main engine of the airplane; is that right?
A Correct.
Q And would that be a bad thing?
A Reverse flow into the APU?
Q Yes, sir.
A Yes, that would be a bad thing.
Q Why would that be a bad thing?
A Because the load compressor, which is intended

which is intended to stop that, could potentially fail and allow high pressure air to come to the APU.
Q When you refer to a check valve, is that the same thing as what we've been calling the bleed control valve? Or a different valve?
A It's a different valve.
Q Did the APS 3200 pass its reverse pneumatic flow tests?
MR. McCRACKEN: Objection; vague.
THE WITNESS: Do you mean the tests we just talked about?
BY MR. PUTNAM:
Q Yes, sir.
A Yes.
Q Do you remember any particular problems with passing those tests?
A No.
MR. PUTNAM: Let me have the court reporter mark this as Exhibit 44.
(Deposition Exhibit 44 marked.)
BY MR. PUTNAM:
Q Mr. Suttie, the court reporter has handed you what she has marked as Suttie Deposition Exhibit 44, which is a one-page memo authored by you, dated October 16, 1990. Production number HSA 152363.

Let me ask you, first of all, to review this document and tell me if you recognize it?
A I remember the subject. I don't recall this particular document.
Q Can you tell me what the document is?
A As I read it now, it's a memo from me to the systems design engineers, discussing the reverse flow requirements.
Q And when you say "reverse flow requirements," is it fair to say that this is referring to the syndrome or the risk of reverse pneumatic flow that you testified about just before I gave you the document?
A Yeah. Yes.
Q Do you see the first sentence of the second paragraph of the memo, says: "The Garrett approach is to monitor their ambient temp thermocouple for a rapid increase in temp signifying a reverse flow condition." Do you see that?
A Yes, I see it, yes.
Q What did you mean by the Garrett approach?
A The logic mechanism used by 36300 APU in the aircraft.
Q And Garrett is a reference to the company that's also been known as Allied Signal and now Honeywell; correct?

you see that?
A Yes.
Q And then there are three separate clauses after that?
A Yes.
Q What did you mean to signify by that part of the memo?
A Suggestions for others to consider. Plus whatever else they could come up with.
Q When you say others to consider, I take it you mean those were suggestions about possible ways that Sundstrand could address this issue of reverse pneumatic flow in what became the APS 3200; correct?
THE WITNESS: Repeat that, please.
(Record read.)
THE WITNESS: Yes.
BY MR. PUTNAM:
Q Can you read into the record the second of the ideas that you put in this memo, Suttie Exhibit 44?
A "2, duplicating the Garrett approach, and."
Q And how did Sundstrand deal with the issue in the actual APS 3200?
A We did a modified version of Item 1. We found that the airflow sensor, the delta P on P sensor, adequately protects the APS 3200 from this condition.

A Correct.
Q How did you know that that was the Garrett approach?
A I don't recall.
Q Was that something you had determined for yourself, or someone had told you was the Garrett approach?
A I did not come up with this myself.
Q And when you say "this," I want to be clear we're talking about knowledge of what the Garrett approach was; correct?
A Correct.
Q And I think you said it was specifically the way that the 36300 APU handled this issue of reverse pneumatic flow; correct?
A Correct. Because I remember being told that false shutdowns, nuisance shutdowns could occur as a result of hot gas recirculation from the main engines. And that that was a problem we were trying to not duplicate.
Q It's your testimony that was a problem with the Garrett approach; correct?
A Correct.
Q Now, I see, maybe the fourth paragraph down that says, "Ideas that come initially to mind are." Do

It, in fact, was never tested by D.A., as I mentioned. Additionally, the inlet temperature sensor of APS 3200 is located in a position which would not allow it to accomplish the function defined in paragraph 2 as the Garrett approach. So it is not possible for us to duplicate that approach.
Q I'm sorry, the inlet what sensor of the 3200?
A Temperature. Referred to here as ambient temperature thermocouple. We don't use thermocouple, but inlet temperature, ambient temperature used synonymously.
Q I'm a little confused. The APS 3200 does or does not measure ambient temperature?
A Measures what we call intake.
Q Which is interchangeable with ambient temperature; right?
A It's not exactly the same, but it's similar.
Q Then I guess I'm confused. If you do measure that, why is it that you're saying you couldn't use Garrett approach?
A Because the location of the sensor is such that it would not provide the -- any useful signal. And additionally, as I mentioned, the delta P on P logic which was used adequately affected it.
Q You referred in answer a couple ago, and the

memo referred on the first line, to capital D, capital A. Do you see that, D.A.? Answer yes for the record.
A Yes.
Q So the record is clear, can you tell us what D.A. refers to?
A Deutsche Airbus.
Q Is that synonymous with Airbus, or German part of Airbus?
A In 1990 that's what the German part of Airbus was known as.
Q Is there a German part of Airbus today?
A Yes.
Q What's it called?
A Currently they're called EADS, which is joint venture company with Air Especiale.
Q Air Especiale is the French?
A French side of Airbus.
Q Do you recall; did you ever do any testing using what you call here the Garrett approach to combat this concern of reverse pneumatic flow?
A We did not.
Q Do you know if it was Mr. Greubel -- first of all, you see that Mr. Greubel was one of the people to whom you sent Exhibit 44?
A Yes.

A Exhibit 45?
Q Yes.
A Yes.
Q Can you tell me what that is?
A It's an interface control document between Sundstrand and Turbomeca which defined the -- Turbomeca's requirements for the control system.
Q And what was the purpose of creating this document?
A To have joint agreement on how the APU was to be controlled, rather than just one party saying, "I want this." This document had to be signed by both parties and by the joint venture organization.
Q And did you lead the effort on behalf of Sundstrand to put together this document, Suttie Exhibit 45?
A Yes.
Q Am I right that Mr. Hardy was your counterpart leading the effort on behalf of Turbomeca?
A Yes.
Q If you turn to the second page of the document you see a heading, "Number 2, Computation of corrected bleed airflow."
A Yes.
Q Can you tell me what is being described in that

Q Do you know if it was Mr. Greubel who identified for you the Garrett approach to the reverse pneumatic flow issue?
A As I said earlier, I don't recall.
Q Okay. What do you understand to be the relationship between Turbomeca and Labinal?
MR. MCCRACKEN: Objection; ambiguous.
THE WITNESS: My understanding, and this is purely my understanding, Turbomeca was a wholly-owned subsidiary of Labinal.
BY MR. PUTNAM:
Q And is it your understanding that that is true today as well?
MR. MCCRACKEN: Objection; calls for a legal conclusion.
THE WITNESS: I don't know the current status.
MR. PUTNAM: Off the record.
(Discussion off the record.)
(Deposition Exhibit 45 marked.)
BY MR. PUTNAM:
Q Mr. Suttie, the court reporter has handed you what's been marked as Suttie Deposition Exhibit Number 45, which is a document labeled "ECB interfaces," with production numbers 226567 through 226576.
Do you have that document in front of you?

section of the document?
A When you say "that section of the document," you mean Section 2?
Q Yes, sir.
A Our air freight customer, Deutsche Airbus, required that the ECB send serial data link signal, RH 429, through the data bus label, which was proportional to the airflow being supplied by the load compressor. That relationship is shown in Table 1, on page 3. This section of the document allowed us to code into software logic which would supply that communication label to the aircraft.
Q If you look at Table 1 on page 3, am I right that that shows the relationship between delta P over P and bleed flow?
A Correct.
Q And what is the unit of measure that's depicted? Or that's meant by g/sec?
A Grams per second.
Q And is that a common way to enumerate airflow?
A It's air mass flow.
Q Am I correct that Section 2 here shows that -- or one thing it shows is that at the time you were still using or planning to use this B critical value?
A Yes.